"The role of proximity effects in transition-edge sensor design and Performance"

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Transition-edge sensor (TES) microcalorimeters and bolometers are under development by numerous groups worldwide for a variety of applications involving the measurement of particle and photon radiation. Recent experimental and theoretical progress has led to the realization that the fundamental physics of some TES systems involves the longitudinal proximity effect between the electrical bias contacts and the TES. As such, these devices are described as SS'S (or SN'S) weak-links exhibiting Fraunhofer-like magnetic field dependence, and exponential temperature dependence, of the critical current. These discoveries, for the first time, provide a realistic theoretical framework for predicting the resistive transition as a function of temperature, current and magnetic field. In this contribution, we review the latest theoretical and experimental results and investigate how proximity effects play an important role in determining the resistive transition characteristics, which ultimately determines the dynamic range and energy resolution of TES detectors. We investigate how these effects could be utilized in device design to engineer desired transition characteristics for a given application.